LIBRARY
NOAA, NMFS Honolulu Lab.
2570 Dole St.
Honolulu, Hawaii 96822-2396

THE EARTH OBSERVER

An EOS Periodical of Timely News and Events

Vol. 5, No. 5

September/October 1993

INSIDE THIS ISSUE

SCIENCE TEAM MEETINGS

MODIS Science Team Meeting 3
TES/AES Science Team Meeting 9

ARTICLES

Network Applications Center News Update 11
Test Sites/Field Experiments Database 12
New Aspect of Global Warming Discussed at International Conference 14
Airborne Measurements of the Greenland Ice Cap 16
SPOT 3 is Launched 18
Preparing for Climate Change 19
–Report of the Office of Technology Assessment

ANNOUNCEMENTS

IRS-1E Launch Failure 10
AVHRR Project Wins Award 13
EOSDIS Core System Requirements Review 15
EOS Science Calendar 20
EOS IWG Meeting Information and Registration 21
Information/Inquiries backcover
Global Change Calendar 23

Editor's Corner

The EOS Payload Advisory Panel meeting was held October 4-6 in Herndon, Virginia. The primary focus of this meeting was on coordination and convergence of EOS mission elements with other programs, such as (i) EOS PM in light of ESA's plans for METOP-1 as well as NOAA's plans for NOAA-O, P, Q and the Department of Defense's plans for DMSP, (ii) EOS Chemistry in light of ESA's plans for ENVISAT-1 in 1998, (iii) remote sensing of land in the EOS era in light of Landsat 7/8, EOS AM-2, EOS PM-2, and SPOT, and (iv) TOPEX/Poseidon follow-on in light of plans for Geosat follow-on and EOS Ocean Altimetry (SSALT/DORIS/TMR).

In addition, the Payload Advisory Panel reiterated the importance of EOS Aerosol (SAGE III) in mid-inclination (56°-73°) orbit (spacecraft and launch to be provided by an international partner) and a new TOMS instrument on Chemistry-1 (to be provided by NASDA). Furthermore, the Payload Advisory Panel recommended in its report that the project proceed with plans to split the EOS Altimetry mission into two separate spacecraft for EOS Land-Ice Altimetry (GLAS) and EOS Ocean Altimetry, respectively.

The EOSDIS Advisory Panel also wrote a section of the report on the status and challenges of EOSDIS, in which they articulated the need to improve the interaction between EOSDIS and the user community, to assure a fully functional, and valuable, data and information system. The full Executive Summary of the joint Payload Advisory Panel and the Data and Information System Advisory Panel Report is intended to appear in the November/December issue of *The Earth Observer*.

On November 12, I sent out a letter to each Team Leader, Principal Investigator, and Interdisciplinary PI that contained a complete list of at-launch and post-launch data products with their corresponding geophysical parameters, storage volume, floating point operations per second, accuracy, etc. This information was the result of an extensive analysis by the Project Science Office following the last IWG, and allows us to identify the "tall pole" algorithms based on either their data storage or processing

requirements. This letter solicits confirmation from the cognizant team that we interpreted their data processing requirements correctly. I believe we are now near a final, well-defined list of geophysical products to be produced by the EOS flight segment. There will no doubt be innumerable research products produced by interested scientists from within as well as outside the EOS community.

There is now an Investigators Working Group (IWG) meeting scheduled for January 11-13 in San Antonio, Texas (see information on pages 21 and 22). The primary focus of this meeting is on (i) hearing a report from the Payload Advisory Panel and EOSDIS Advisory Panel on recommendations for EOS spacecraft and ground segment components and architecture, (ii) discussing plans for calibration and validation of EOS instruments and data products, (iii) learning of recent progress and exciting accomplishments obtained thus far by various EOS investigations, including data assimilation and ocean topography, and (iv) discussing global climate change and policy-relevant research accomplishments and plans.

—Michael King
EOS Senior Project Scientist

From *EOS.NEWS*

SECOND SWAMP WORKSHOP

The Science Working Group for AM Project (SWAMP) met on November 4-5 at the Goddard Space Flight Center in Greenbelt, Maryland. Updates were presented for the status of each AM-1 instrument (ASTER, CERES, MISR, MODIS and MOPITT), pointing studies, requirements for digital elevation data, status of algorithms for merged/advanced products (clouds, surface radiation, vegetation), requirements for gridding data products, calibration activities, and validation plans. Algorithm development was discussed in detail, including the need to: 1) initiate a scientific review process; 2) identify the responsibilities of the instrument science teams and the EOS Project; 3) develop schedules for review and delivery; 4) identify data sets for testing algorithms; 5) develop protocols for writing technical documentation and planning budgets; and 6) monitor the availability and appropriateness of Product Generation System toolkits built by EOSDIS for science teams. It was recommended that each instrument science team identify an algorithm development representative to coordinate reviews and documentation as needed by the AM Project, as has been arranged for calibration issues. (A full report on this meeting will be published in the next issue of *The Earth Observer*.)

CONGRESSIONAL HEARING ON CONVERGENCE

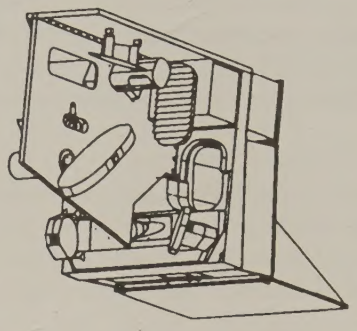
On November 9, the Space Subcommittee of the House Science, Space and Technology Committee held a hearing on the convergence of civilian and defense polar orbiting weather satellites, along with any related contributions from EOS. Rep. Ralph Hall was Chairperson and testimony was heard from representatives from NOAA (D. James Baker), DoD (George Schneiter) and NASA (William Townsend). The purpose was to investigate ways of reducing weather satellite costs estimated at $6 billion over the next 10 years. Studies by a Tri-Agency Working Group began in June and will make recommendations to agency heads by January 1994. The results of this study will be turned over to the President's Office of Science and Technology Policy (OSTP) which will submit to Congress before April 30, 1994 a detailed implementation plan for convergence of the satellite programs. The target for savings is $300 million over the next five years. It was suggested that the House Committee would make further inquiries into whether the present DoD program, with 2 satellites in orbit, 5 in storage, and 4 in the works, is an excessive expenditure (at $120M per satellite). The main issues regarding EOS are 1) the degree to which the observational capabilities of PM-2 and PM-3 flights (AIRS/AMSU/MHS, CERES, MIMR, and MODIS) will become operational under the converged weather satellite program, and 2) the ability of NASA to support requirements for global change research that are beyond or distinct from operational requirements. All three witnesses agreed that a single agency should administer and run a converged satellite program. The OSTP plan to be submitted to Congress should make a final recommendation as to which agency should run the converged weather satellite program.

Science Team Meetings

MODIS Science Team

(Moderate-Resolution Imaging Spectroradiometer)

—**David D. Herring**, MODIS Executive Secretary, Science Systems and Applications, Inc. (301) 286-9515



The MODIS Science Team met in three plenary sessions and four discipline group sessions—Atmosphere, Calibration, Land, and Oceans—September 29-October 1, 1993, at GSFC.

Plenary Sessions

Dr. Vincent Salomonson, MODIS Team Leader, welcomed the meeting attendees and noted that for the first time each MODIS Discipline Group will report on the science behind MODIS during the Plenary Session. He reminded the Team that the deadline for first delivery of code is January 3, 1994. Salomonson introduced Janine Harrison as the new MODIS Administrative Support Team (MAST) Leader; she succeeds Locke Stuart.

Michael King, EOS Senior Project Scientist, summarized the most recent EOS IWG (Investigators Working Group) meeting. The focus of that meeting was on the development of each instrument's list of data products. These lists will help EOSDIS size the storage and processing requirements for all EOS data products. Bob Evans interjected that EOSDIS needs to be flexible so that new science can be incorporated as the Team learns and technology improves over the next few years.

King reported that a series of seven posters are being developed which illustrate the EOS theme. Also, an EOS brochure was printed. A 10-minute animated video was produced showing the operation of MODIS' optics.

Salomonson announced that on January 3, 1994, Shelby Tilford will be succeeded by Charles Kennel, a faculty member of the Physics Department at UCLA since 1972. Kennel specializes in plasma physics. Salomonson thanked Tilford for bringing EOS this far.

Frank Muller-Karger presented the new Mission to Planet Earth (MTPE) organization. He said there are three divisions: Flight Systems, Science, and Data Processing. Muller-Karger praised the MODIS Team for its accomplishments to date. He said MODIS' handling of the stray light problem was particularly impressive. He commended the Land Group on its LTER (Long-Term Ecological Research) site selection and the Ocean Group on implementing its SeaWiFS field calibration scheme.

Muller-Karger stated that because the cost is high, HQ is trying to avoid excessive requests for funds for airborne campaigns, both within and outside of EOS. HQ feels there needs to be a strategy to cut these costs while still collecting needed airborne data. He encouraged team members to collaborate with other team members whenever possible, and to work with Instrument Team Leaders to help carry the burden of cost for airborne campaigns. Muller-Karger said he will facilitate dissemination of airborne campaign schedules.

EOSDIS Status Update

H.K. Ramapriyan (Rama) gave an update on EOSDIS activities. The ECS SRR (EOSDIS Core System Software Requirements Review) was held September 14-15. EDOS (EOS Data and Operations System) proposals were received at the end of March and are under evaluation. An award is planned for December, 1993. The Independent Validation and Verification (IV & V) contract will be awarded in February, 1994. The ECS contract was awarded to Hughes Applied Information Systems (HAIS) in March, 1993.

Rama compared previous and current processing and storage estimates for EOS data products; he noted that between May and September of this year the estimates for the AM platform increased by a factor of 5. EOSDIS is now trying to determine whether they can afford the hardware to support this increase.

Rama introduced Steve Wharton as the new EOSDIS Project Scientist. Wharton stated that his current objective is to facilitate communications between EOSDIS developers and the EOS science community. He will promote the development of an implementation plan for end-to-end data product support and expand the scope of the Science Data Plan to incorporate all EOS data products.

Global Imager (GLI) Report

The MODIS Science Team meeting was attended by a contingent from NASDA (Japan's National Space Development Agency). Dr. Y. Haruyama, NASDA Senior Engineer, stressed the importance of cooperation between the United States and Japan in the Global Change Initiative. Haruyama introduced Mr. Tange, who gave an overview of the GLI's technical capabilities.

MODIS Project Reports

Richard Weber gave a MODIS contract status update. He reported that cost caps are currently being met by Santa Barbara Research Center (SBRC), but the schedule is slipping some.

Weber announced that SBRC conducted a major exercise to "exorcise" the ghost image problem in MODIS and their results are better than was expected. Signal-to-noise ratio (SNR) specs are being met in all but one band. Regarding the MODIS subsystem overview, Weber reported that the engineering model focal plane assemblies (FPA) have been built. MODIS' mainframe fabrication is nearly complete, tests on the scan mirror are underway, most of the wiring boards are designed, and SBRC has received the radiative cooler parts. Weber stated that the calibration accuracy looks good and the ground support equipment (GSE) is progressing well.

Tom Pagano gave a MODIS status summary from SBRC's perspective. Pagano introduced Oscar Weinstein as SBRC's new Deputy Program Manager. Pagano reported that some of the major MODIS subsystem hardware assembly has been completed on the engineering model. The aft optics platform has been fabricated and delivered to SBRC; all dichroic beamsplitters are in hand and the detector arrays are working (except for the LWIR which is having minor problems); all four focal planes are ready for filter assemblies, final tests, and delivery; the electronics module design is complete; and the scan mirror motor controller is assembled. Fabrication of the SRCA (Spectroradiometric Calibration Assembly) is nearly complete and the SDSM (Solar Diffuser Stability Monitor) is in the final stages of design. The Solar Diffuser design has been determined and will be drawn when the SDSM is finished. The blackbody design is complete.

Land Group Science Presentation

For the first time, each MODIS Discipline Group gave a presentation on broad scientific aspects of MODIS that are currently at the forefront of the Teams' attention. Chris Justice introduced Steve Running, who began his presentation with an EOS-wide perspective on MODLAND products. Initially, he said, the two central objectives of the MODIS Land Group were to provide data on greenhouse gases, and primary productivity and the water cycle. Running said the Land Group is developing algorithms to provide global land cover and vegetation overviews. He hopes to be able to identify classes of plants globally through remote sensing—first simply to classify them, later to discern their more-complex qualities. For example, Running hopes to be able to determine whether plants are perennial or annual; whether their leaves are coniferous or deciduous; whether they are broad-leafed, needle-leafed, or simply grass. Running said that the Science Teams' algorithms are continually improving so he hopes EOSDIS will be flexible enough to not "freeze" algorithm development until the last possible moment.

Alfredo Huete stated that the Land Group is not just working on NDVI; they feel they can do better by relying on more recent research. Although MODIS' NDVI will be the most sophisticated index of its kind and will reduce noise to a minimum, there are still some problems to address. NDVI, he explained, is very sensitive to ground-

based and atmospheric contamination problems and, theoretically, can't be validated. Justice pointed out that it is difficult for the Land Group to obtain a dataset because they are constrained by cost at the moment. They are interested in accessing aircraft data taken by MODIS Airborne Simulator (MAS); also, they are interested in working with other groups to share data.

Atmosphere Group Science Presentation

Michael King presented his work on remote sensing of cloud optical thickness and effective particle radius. He gave a status update on the MAS, the purpose of which is to simulate the majority of atmosphere and land channels of MODIS prior to launch, obtain measurements of reflected and emitted radiation with a single instrument under a wide variety of earth-atmosphere conditions, compare retrievals of atmospheric and surface properties with nearly simultaneous *in situ* aircraft and surface observations, and perform calibration intercomparisons during MODIS overflights.

King stated that the following are outstanding problems facing the Group and requiring future work: incorporate Rayleigh and aerosol corrections into retrieval algorithms, look into the influence of boundaries on atmospheric retrievals, incorporate multiple channels into retrievals (including 1.64, 2.13, and 3.75 μm), examine multiple-layer clouds using data collected during TOGA-COARE and CEPEX, and study the impact of ice and mixed-phase clouds on atmospheric retrievals of optical thickness and effective radius.

Paul Menzel gave a presentation on inferring cloud top properties from MODIS observations. Menzel explained that clouds are a strong modulator of shortwave and longwave components of the Earth radiation budget—knowledge of cloud properties and their changes in time and space are crucial to studies of weather and climate. Menzel is developing an algorithm to use on MODIS data, but is practicing the algorithm using HIRS (High Resolution Infrared Sounder) data taken over high, semi-transparent thin clouds. He said MODIS' good NEΔT is needed to detect thin cirrus clouds.

Yoram Kaufman presented his work toward understanding how aerosols affect climate. Specifically, he is interested in direct and indirect aerosol forcing and the potential for aerosol to counteract greenhouse warming. He explained that aerosol can affect climate by directly reflecting sunlight to space and indirectly by increasing cloud reflectance. Kaufman is also interested in the remote sensing aerosol data from present satellites and using these data to study how aerosol interacts with clouds. Kaufman stated that MODIS will be better equipped to gather these data than AVHRR—MODIS has better channels, better resolution (on some bands), measures water vapor, and retrieves surface parameters better.

Oceans Group Science Presentation

Wayne Esaias gave a status report on SeaWiFS. He stated that at the next Science Team Meeting the Oceans Group will give a multimedia presentation on sea surface temperature (SST) data. Esaias reported that the target launch date for SeaWiFS is still July 22, 1994. SeaWiFS' spring Science Team Meeting will focus on algorithms, software use, validation, and the DAAC. Esaias reported that the SeaWiFS Team has successfully addressed the bright target recovery and ghosting problems. Contract modification was completed August 27. SBRC has improved SeaWiFS' electronic response, tilted the filters, and modified the bilinear gain function and all other associated gains. According to Esaias, in late October the SBRC will resurface the polarization scrambler, perform instrument characterization, and attempt an onboard cloud flag for GAC (Global Area Coverage) data. Esaias said there is a need to study correction routines for LAC (Local Area Coverage) and mask for GAC for very bright targets in the NIR bands.

A marine optical buoy (MOBY) will be moored off the coast of Lanai, Hawaii, to help calibrate and validate SeaWiFS. Dennis Clark is heading the MOBY efforts, funded by both SeaWiFS and MODIS. MOBY is about 17 meters long and is equipped with sensors for measuring upwelling and downwelling radiance. MOBY will provide a time-series data base for bio-optical algorithm development for SeaWiFS and MODIS.

MODARCH Presentation

David Herring and Michael Heney gave a presentation on MODARCH, MODIS' new electronic document archive. Herring summarized the research efforts leading up to the procurement of the system. Herring and Paul Baker, Presidential Management Intern with the Goddard Library, evaluated MODIS' paper archive, surveyed the MODIS Team to determine their preferences, evaluated other archives being operated by other agencies, investigated new electronic archiving technologies available commercially, and then recommended the system they felt would best meet the Team's needs based on all of this input. In July, MAST procured Excalibur Technologies' PixTex/EFS (Electronic Filing System) software and the hardware necessary for ingesting documents in either

hardcopy or electronic form. Collectively, for simple reference and in order to assign it an internet address, this system is named "MODARCH."

Heney gave an actual on-line demonstration of MODARCH. He explained that tens of documents were entered into the system in order to begin the pilot phase of MODARCH in which the system was tested by select members of the MODIS Team. Using a Macintosh PowerBook running the EFS client software, Heney accessed MODARCH over the Internet from Building 8, typed in a search "clue", and in seconds retrieved information. Heney explained that MAST has completed the MODARCH pilot and is ready to begin the full operation of the archive—MAST is now distributing EFS client software to the entire MODIS Team. Questions/comments regarding MODARCH should be addressed to Michael Heney either via e-mail at mheney@ltpsun.gsfc.nasa.gov, or phone (301) 286-4044.

Bowtie Effect and Volcano Alarm

Ed Masuoka discussed the MODIS beta software development objectives and presented the development schedule. He reminded the Team that beta software is due to be delivered January 3, 1994. Masuoka introduced Al Fleig to address the "bowtie" effect which will be seen in MODIS' scan geometry. Fleig explained that at nadir a MODIS pixel will "see" a 1-km by 1-km area, and at the edges of the swath a pixel will see an area 2 km by 5 km. Moreover, Fleig explained, there will be a 50 percent overlap of the pixels out toward the edges of the swath. Fleig stated that the Science Team members must compensate for this bowtie effect in their texture algorithms if they intend to do visual quality control checks of their data. He pointed out, however, that the data will not be wrong—the geolocation will be correct, the image will simply not look like what is actually on the ground. The data will need to be resampled. John Barker explained the bowtie effect which will be seen toward the edges of the swath at a 55° slant angle from nadir. Barker stated that this effect may actually improve MCST's ability to do histogram equalization—they may be able to equalize after only a few scans, rather than requiring a full orbit as was originally thought.

Fleig presented a letter from Peter Mouginis-Mark requesting that MODIS be used as a volcano alarm. Fleig said this could be done quickly and easily without impacting MODIS' data or resources. It would, however, impact EDOS because the data must be transmitted and processed quickly 100 percent of the time. Mouginis-Mark concedes that he will be happy with transmission and processing 70 percent of the time.

MODIS Calibration

John Barker began his presentation with a discussion of the MODIS Level 1 characterization and calibration algorithm. He said their strategy is to use a single calibration algorithm because it must be operative for more than 15 years for 6 MODIS instruments. Several calibration methodologies will be implemented throughout the 15-year mission to provide a robust calibration algorithm that can be validated by independent methods. Barker reported that MCST will use time-dependent radiometric calibration of MODIS' reflective bands to determine the instrument's precision. The solar diffuser will be used several times per month until MCST learns how best to use it. Barker stated that MODIS must have lunar looks, a capability which is not currently funded. He noted that the EOS Project is considering adding a roll maneuver capability, but that maneuver will not allow for a direct look at the moon, which is needed for cross calibration of MODIS with ASTER or MISR.

Calibration Group Summary Report

Phil Slater gave the Calibration Group's Final Plenary report. Slater said there is considerable interest in including contamination monitors on the AM-1 platform both to determine the initiation, frequency, and duration of solar-diffuser and scan-mirror door deployment, and also to help diagnose the degradation and change in calibration of the various optical sensors. The Calibration Group recommends that the system-level specification be rewritten for the out-of-band (OOB) response of some filters that presently have a 5 percent requirement. The latter is inconsistent with the radiometric calibration uncertainty specification. Slater stated that the present round-robin cross calibration activities for SeaWiFS will conclude this year. He feels that MODIS should adopt a similar cross-calibration strategy.

Atmosphere Group Summary Report

Michael King announced that the Atmosphere Group will collaborate with CERES on producing cloud mask algorithms. He said that particularly Bruce Wielicki, Brian Baum, and Ron Welsh will be asked for their input. He said there was a meeting last week in Denver on how the two teams will interface their algorithms. At the first SWAMP meeting Piers Sellers assigned Wielicki the task of coordinating the cloud masking efforts. King said that IR calibration is a concern. Paul Menzel will work closely with the MODIS Calibration Group on this issue.

King stated the scattering properties of cirrus clouds are a major uncertainty in understanding cloud-radiation

interaction. He said there are no good measurements of size distribution of the non-spherical ice crystals in cirrus clouds. He feels the 1.38-μm channel will help gather these data, but the algorithm used will be state-of-the-art.

All atmosphere Algorithm Theoretical Basis Doucments (ATBDs) have been completed, but all have not been distributed yet. He explained that ATBDs were first done by the UARS (Upper Atmosphere Research Satellite) Team, which had their software generated 5 years before launch. King stated that all teams within EOS will be asked to produce ATBDs. He said there will be a science review within the next fiscal year for the AM1 instrument teams as well as for LIS and SeaWindS, based on the ATBDs.

King stated the Atmosphere Group is committed to participating in the SCAR-C field campaign next year. He reported the flights have already been approved. There will be some cirrus experiments during SCAR-C. The MAS instrument will be enhanced prior to SCAR-C—it will have a 12-bit digitizer for all 50 channels.

EOSDIS Rapid Processing

Piers Sellers briefly discussed quick look requirements for EOS data. He explained that the idea is to allow EOS data users to shop through small segments of data shortly after they are acquired; however, he said, adding this capability will be very expensive. He observed that the Land and Atmosphere Group does not need quick-look capability. Esaias stated that as long as there is some quick readout capability for locating and tracking anomalies, the Oceans Group does not need quick-look data. Dave Diner added that some quick-look capability is required for MISR. They need access to data within 1-2 hours of the satellite's scan.

Barker stated that he had assumed quick-look data was a flight operations issue because it is not a cost issue; there is, however, a transmission issue. Fleig added that there were constant requests for quick-look data from the Nimbus Team. Moreover, he said, quick-look capability will add relatively little cost.

Land Group Summary Report

Chris Justice reported that all Land ATBDs are completed and will undergo internal review and revision by MODLAND prior to external distribution. Justice stated that the Land Group is concerned with the pre-launch calibration of the 3.95-μm channel. Also, they are soliciting ideas on calibrating MODIS after launch. He feels MCST should address the issues associated with vicarious calibration using off-nadir sensors.

Regarding geolocation, Justice stated that MODIS' will be better than AVHRR. However, the Land Group wants to explore options for improving geolocation accuracy through ground processing—MODLAND requires 0.1 of a 1-km pixel. Justice asked SDST and MCST to develop options and associated budgets for ground processing to meet their registration requirement. Additionally, he feels that angular displacement monitors on instruments should be evaluated to address high frequency jitter.

Justice stated that data access is a concern—the Land Group has had problems getting data from the DAAC due to the considerable cost. Justice said he would like to see a comprehensive bibliography in MODARCH of all MODIS-related journal articles. Janine Harrison said that including copyrighted materials prepared by non-MODIS Team members in the archive presents a legal concern which she is pursuing.

Oceans Group Summary Reports

Regarding data products and ATBDs, Wayne Esaias reported that the Oceans Group has changed its CZCS pigment product to chlorophyll-*a* concentration and has deleted the backscatter product. He explained that Howard Gordon will concentrate on his whitecap corrections and aerosol effects algorithms. He announced that the Ocean ATBDs are progressing. Regarding the Level 1 Radiance Calibration ATBD, Esaias stated that the Oceans Group will produce a list of comments which they will forward to Bruce Guenther and John Barker.

He reminded the Team that the SeaWiFS launch is only a year away; funding for SeaWiFS will decline drastically after this year. Additionally, the round-robin calibration/validation efforts decline after 1994. He said the Ocean Group will work to ensure that there is continuity in their algorithm development from SeaWiFS to MODIS. Esaias feels that MCST should take the lead in incorporating recent improvements in calibration technologies.

Esaias stated that EOS Color remains an essential component of EOS; however, not much progress has been made in determining how its data will be handled or how the mission will be approached since the last Science Team Meeting. For example, Color doesn't even show up in any EOSDIS data charts—there is a need to begin management and data processing planning for that mission. Esaias said there needs to be more interaction with non-United States GCI missions. He feels that the Japan-U.S. Working Group on Ocean Color (JUWOC) initiative is working well. Also, the OCTS interactions have been

well-coordinated—agreements have been made on data and software exchange, as well as cal/val interactions.

Esaias stated that some quick look data is required for effective planning of cruises to obtain calibration data. The Oceans Group will need some quick look data within 24 hours of acquisition, and they will need them on several bands. Fleig observed that Level 0 data arrive during processing 21 hours after acquisition, and Level 1 data are available another 24 hours later.

Closing Remarks

Salomonson reminded the Team that ATBDs are due and should be submitted as soon as possible for peer review. The next MODIS Science Team Meeting will be held April 13-15, 1994, at GSFC.

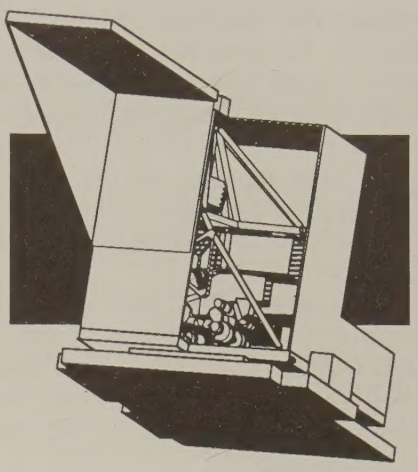
Piers Sellers, EOS AM Project Scientist, explains the quick look requirements for EOS data at the recent MODIS Science Team Meeting.

Vern Vanderbilt (left) and Alan Strahler (right), both MODIS Land Group members, attended the MODIS Banquet held at the Newton White Mansion. Pictured in the background is Oscar Weinstein, of SBRC.

TES/AES Science Team

(Tropospheric Emission Spectrometer/Airborne Emission Spectrometer)

—**Reinhard Beer**, Jet Propulsion Laboratory. (818) 354-4748



The TES/AES Science Team met for the eighth time at JPL October 20-21, 1993.

Unfortunately, due to prior commitments, no representatives were present from NASA HQ or Harvard University.

As usual, the Data Analysis Working Group (chaired by Curt Rinsland, NASA Langley Research Center) met the day before the main meeting. Tony Clough (AER Inc.), Larry Sparks (JPL), and Paul Morris (Oxford) presented status reports on the retrieval algorithms LBLRTM and SEASCRAPE and the forward-model algorithm GENLN2. All of these are taking advantage of recent improvements in H_2O continuum coefficients and CO_2 line-coupling parameters. A repeat of the intercomparison of the forward-modeling parts of these codes shows that, in the chosen region (the center of the 9.6 μm O_3 band), the three now agree to within a fraction of 1%. This is very gratifying because other such intercomparisons have often disagreed markedly. It was also agreed that the retrieval algorithms should employ analytic, rather than finite-difference, partial derivatives, not because of greater accuracy but because of the significant reduction in computation time required.

Larry Sparks also described an "acceleration algorithm" he has developed for SEASCRAPE. While not yet fully validated, it offers speed improvements in the forward-modeling process of up to two orders of magnitude. A "hands-on" demonstration of the user interface to SEASCRAPE (SEAfront) was also provided.

Helen Worden (JPL) described her studies of Phase Correction, intercomparing all known approaches and a new one developed by her and Jack Fanselow (JPL) that involves performing a low-order polynomial least-squares fit to the empirical phase function. The performance of this new approach is impressive on synthetic phase-distorted interferograms.

We expect to begin a similar intercomparison with real AES data within a few weeks.

Aaron Goldman (U. Denver) described his new analyses of the nitric acid spectrum. The strengths of the four principal infrared bands are a subject of considerable controversy, but we hope that these new measurements will go far towards resolving this issue because HNO_3 is planned to be a TES Standard Data Product.

The Plenary Sessions began with overviews of the status of the TES and AES Programs and Project by Reinhard Beer and Tom Glavich (JPL). The major news is that the Atmosphere Panel has recommended that TES be moved forward from the AM-2 platform to CHEM. This became possible when a compromise Equator crossing time of 1:30 PM was agreed upon by all the CHEM PI's. Preliminary accommodation studies show that TES can fit on an ATLAS 2AS-launched platform without interfering with any of the current instruments. However, it is not clear that this would be the case if a DELTA launch were mandated—not because of mass but because of the much smaller DELTA shroud.

In general, both AES and TES are moving ahead on schedule and within budget.

"Risk Reduction" activities for TES are nearing culmination with a 2-million-cycle life test of a candidate scan mechanism that will begin shortly. Technology transfer from AES to TES is essentially complete. The next major milestone is the Conceptual Design and Cost Review (CDCR), which is currently planned for the Spring of 1995.

Reinhard Beer reported on the recent Payload Panel meeting near Dulles Airport (at which the aforementioned proposal to shift TES to CHEM was made).

Major discussion topics were the capabilities of ESA ENVISAT and METOP programs and the forthcoming Japanese ADEOS and Japanese/U.S. TRMM missions. The issue of "convergence" of the DoD, NOAA, and MTPE programs was also debated at some length, but without obvious resolution.

Another major topic was a report by the EOSDIS Advisory Panel on the status of the DIS. Some concern was expressed by this panel about what are perceived as shortcomings of the proposed approach.

Following a presentation on the AES instrument status by Wally Porter (JPL), the meeting adjourned to the laboratory where AES is in the final stages of assembly. This, in turn, was followed by Reinhard Beer providing an outline of the Mission Plan and the specific Flight Plan for the first P-3 deployment from Wallops Island next April.

The day concluded with a demonstration of the on-line AES data catalog. This catalog will be publicly-accessible once operations commence.

The final day was highlighted by a talk by Joy Crisp (JPL) on the nature and chemistry of volcanic plumes. Measurements of such plumes are specifically included in both the TES and AES Mission Plans. Crisp discussed the science that the Volcanology IDS team hopes to extract from the observations.

Rich Cageao (JPL) then discussed the nature and availability of various types of correlative measurements and validations for AES. Tony Clough pointed out that the ARM site in Oklahoma, which is heavily instrumented, would make an ideal target for future AES flights.

Peter Venters (Oxford University) showed a concept for TES ground calibration at Oxford and some initial thoughts on the in-flight calibration.

The meeting concluded with an agreement to hold the next meeting at the University of Denver on May 25-26, 1994. The Data Analysis Working Group will meet in Executive Session on the day before.

From EOS.NEWS

IRS-1E Launch Failure

On September 20, the Indian Space Research Organization (ISRO) reported that an Indian Remote Sensing (IRS-1E) operational weather satellite was placed into the wrong orbit when its newest rocket, the Polar Satellite Launch Vehicle, veered off course and failed to reach the proper altitude. Previous copies of IRS-1 satellites, which carry an ISRO camera system and a German stereoscopic imaging system, were launched by Russian rockets in 1988 and 1991.

Network Applications Center News Update

—From Information Systems Newsletter, by **Mary Stahl** and **April Marine**, Ames Research Center

NASA's Network Applications and Information Center (NAIC), part of the Advanced Network Applications group at Ames Research Center, provides network information and advanced application support services to users of the multiprotocol NASA Science Internet (NSI). It also provides information about the NSI to general users.

Operational since March 29, 1993, the NAIC has significantly enhanced the basic services offered to NSI users. A new toll-free phone number was announced in June. Now, NASA network users within the U.S. can receive assistance by calling (800) 858-9947. Callers phoning from outside the U.S. should continue to use the NAIC's local number, (415) 604-0600. NAIC staff are on hand to answer the phone from 8 a.m. to 5 p.m. PST, and will promptly return voice mail messages left during other hours.

On the NAIC host computer (naic.nasa.gov), users can access a variety of online services as well as an extensive archive of online files that are accessible through anonymous FTP. Users also receive general support via e-mail. Users on Internet hosts should send mail to naic@nasa.gov. Users on DECnet hosts should send mail to EAST::"naic@nasa.gov". All e-mail messages to NAIC will be answered in a timely manner.

Progress is being made toward developing a coordinated NASA-wide support system of distributed Center Network Information Centers (CNICs). The first NASA NICs working group meeting convened in June at the Lewis Research Center. The working group is in the process of devising mutual agreements on how the NAIC can best support the CNICs, how new CNICs can be established for sites that now lack them, and how the representatives of each CNIC can develop this new concept into a strong matrix of cooperating, interdependent NASA CNICs offering the best support to NASA users.

During the past three months, NAIC staff have transitioned and updated the information platform created by the NSI NIC (formerly at Goddard Space Flight Center). The NAIC is working toward a distributed NIC architecture that will locate scientists' or researchers' most immediate support at the Centers where they work. Until each Center has such a CNIC in operation, NAIC itself will provide information support to many NASA users.

Moving toward that goal, the NAIC has taken several steps. In addition to the new toll-free phone number, the NAIC has implemented an Internet Gopher server on the naic.nasa.gov host. Gopher is an easily used menu-driven program that presents the user with an interface to a wide variety of types of information located on host computers throughout the Internet. By using the program, network users are able to not only access information about the NAIC and the NASA Science Internet, but link to several NASA online resources, including the Master Directory, Spacelink, NASA News, online archives, and Gopher servers at other NASA Centers.

The NAIC Gopher is linked to all the other known Gopher servers in the world (there are more than 500). This enables users to access information in such diverse fields as biology, botany, astronomy, medicine, agriculture, and photonics. Many universities and most Internet information centers provide information through Gopher servers.

To access the NAIC Gopher from an Internet host, users should open a telnet connection to the host naic.nasa.gov and log on as 'naic'. Users on DECnet hosts should first SET HOST EAST, then type 'naic.nasa.gov!' at the first login prompt, and type 'naic' at the second login prompt.

Contact the NAIC for a more-complete picture of their services or to obtain help in accessing any of those services. NAIC staff would be happy to send hard-copy packets of information to network users who request them.

To contact the Network Applications and Information Center:
Internet: naic@nasa.gov
DECnet: EAST::"naic@nasa.gov"
Phone: (800) 858-9947 (from within the U.S. only) or (415) 604-0600
FAX: (415) 604-7300

Test Sites/Field Experiments Database (TFDB)

—**Bruce Guenther**, **Yun-Chi Lu**, and **Lalit Wanchoo**, NASA/GSFC, Greenbelt, MD 20771. (301) 286-5205

The Earth Observing System (EOS) is a long-term, multi-disciplinary mission to study global-scale processes that shape and influence the Earth as a system. The primary objective of the EOS mission is to provide long-term observations and the supporting information necessary to develop a comprehensive understanding of the Earth system. Before the first satellite of the AM series is launched in 1998, various scientific algorithms will have to be developed and validated, using simulated data based on field experiments carried out at various test sites. Each science discipline group (land, atmosphere, oceans, or calibration) has its own specific requirements for field experiments and test sites. During the sixth EOS Calibration Panel meeting at San Diego, CA on January 28-30, 1993, the test site requirements for EOS instruments were discussed. Preliminary test sites considered for some of the EOS instrument teams, such as ASTER, CERES, MODIS, and MISR, were described by the team representatives.

At the meeting, the Panel members recognized a need for a central repository to compile and disseminate information on available test sites and various field experiments. It was also recognized that the existing on-line systems, such as NASA Fiducial Laboratories for International Natural Science Network (FLINN) for Crustal Dynamics and DOE's Atmospheric Radiation Measurements (ARM) program for carbon dioxide and fossil fuel burnings, are not sufficient to support calibration and validation activities of the EOS program, mainly because of lack of ecological and geological information. The panel members expressed their interest in developing an on-line database system that provides information on test sites currently in use or being planned, including those in foreign countries.

The TFDB is designed to help facilitate the planning of field experiments necessary for the calibration of the EOS instruments and the development and validation of various scientific algorithms. The objectives of the TFDB are to:

- serve as the central repository for the collection, archiving, and distribution of the test site and field experiment information relevant to the EOS Program;
- support the EOS calibration and validation activities by providing a mechanism to share the most up-to-date test site and field experiment information among EOS science users, and
- act as a source of EOS scientific information that is complementary to the EOSDIS Science Processing Data Base (SPDB), which provides comprehensive information on EOS instruments, platforms, data products, algorithms, and investigators.

The TFDB is an on-line system which allows users to interactively query, search, and download desired information. It is completely menu-driven and provides an easy-to-use user interface based on JYACC Applications Manager (JAM) and Oracle Relational Database Management System (RDBMS). The development of the TFDB will be accomplished in three steps: Alpha, Beta, and Operational Version. Alpha version offers a limited functionality with information for a few selected test sites. Beta version provides system enhancements both in functionality and contents. It also incorporates all of the comments and suggestions received during the release of the Alpha version. Operational version offers a full functionality including capability to link to other on-line systems such as FLINN and ARM. It will include complete information on test sites and field experiments. Both character- and graphic-based versions of the TFDB will be offered, supporting VT-100 class as well as X-terminal users.

Currently, Alpha version is available. It supports VT-100 class terminals. It contains information on six test sites and allows users to interactively query, search, and download information of interest. In addition, it provides on-line capability to submit comments and upload site information. The TFDB is developed and maintained by Yun-Chi Lu, Code 902, NASA/GSFC, Greenbelt, MD 20770, in cooperation with Bruce Guenther, Code 925, NASA/GSFC. For test site information that can be included in the database, or for comments and suggestions, contact Lu or Guenther. Procedures to access the TFDB are described below.

How to Log Into the TFDB

Your equipment determines which connection method to use: dial-up or network. If you have a terminal or PC

with a modem and communications software, you can use dial-up access. If your terminal is connected to a computer that is on a national network (e.g., NAN or SPAN), you can use the network access procedures. In the examples given below, computer prompts are shown in *Italics* and user entries are shown in **bold** text.

NOTE: The current version of the TFDB supports only VT100 class terminals. Terminals and PCs must be VT100 compatible or have VT100 terminal emulation software installed. VT2XX and VT3 xx series terminals must be set to operate in VT100 mode.

Dial-up

301-286-9000 (2400 baud)
or
301-286-4000 (9600 baud)
Enter number: **sisc <CR><CR>**
Enter username> **your name**
Local > **c spso2**
Login: **tfdb**
Password: **spsotfdb**

Using Internet

telnet spso2.gsfc.nasa.gov
or
telnet 128.183.112.16
Login: **tfdb**
Password: **spsotfdb**

Using NSIDecNet (VAX/VMS)

rlogin spso2/username=tfdb
Password: **spsotfdb**

Using NSIDecNet (Unix)

rlogin spso2 -l tfdb
Password: **spsotfdb**

How to Access Information

The TFDB is completely menu driven and requires no special keys. Use of cursor keys allows moving between menu options and <CR> executes the selected option.

There are three ways of moving through menus:

1. Move the cursor with **arrow keys**.
2. Use **Space Bar** to move from top to bottom of menu options.
3. Type the **initial letter(s)** of an item. *Caution*: if the letters you type uniquely identify that item in the list, the item will also be automatically "chosen" (i.e., executed). To type a new set of initial letter(s), tab to the next item and start typing again.

To enter information in the various fields of user information, upload software information, and comments form; use **tab and arrow keys** to move from one field to another field. The **<CR>** will provide either menu options or implement selected menu option.

How to Exit The TFDB

User can Exit the TFDB by selecting **Exit The TFDB** option from any menu and answer **Yes**. If answered **No,** program will return to the menu. This option has been provided in most of the menus.

How to Get User Support

User's guide and related TFDB documents can be obtained from:

Dr. Bruce Guenther, Code 925
NASA/GSFC, Greenbelt, MD 20771
(301) 286-5205
guenther@highwire.gsfc.nasa.gov
or
Dr. Yun-Chi Lu, Code 902
NASA/GSFC, Greenbelt, MD 20771
(301) 286-4093
lu@spso.gsfc.nasa.gov

AVHRR PROJECT WINS AWARD

The Global Land 1-km AVHRR Data Set Project, co-sponsored at NASA by the EOS Pathfinder Program and the EOS Data and Information System (through the EROS Data Center) has won a 1993 Federal Leadership Award. These awards recognize federal projects and programs that have made exceptional contributions to mission effectiveness, cost-effectiveness, and service to the public through the use of automated information systems.

New Aspect of Global Warming Discussed at International Conference

—**Tom Karl**/NOAA, National Climatic Data Center, (704) 271-4319; NOAA; **George Kukla**/Lamont-Doherty Earth Observatory, Columbia University, (914) 365-8421; **Michael Riches**/Environmental Sciences Division, Department of Energy, (301) 903-3264

Thirty-seven scientists from ten countries met recently to discuss a new aspect of global warming: much more of the warming is occurring at night than during the day.

The conference was the first international interdisciplinary effort to discuss observations, causes, and impacts of this phenomenon.

Held in College Park, Maryland, the conference was co-sponsored by the Department of Energy and the Department of Commerce's National Oceanic and Atmospheric Administration. The Energy Department's Environmental Sciences Division has spent the last decade examining the climatic effects of burning fossil fuels. This environmental issue is also being addressed by NOAA's National Environmental Watch Program.

The conference followed the publication of a study headed by Tom Karl of the U.S. National Climatic Data Center and George Kukla of Columbia University. The results were reported in the *Bulletin of the American Meteorological Society* and in the American Chemical Society's *Environmental Science & Technology* journal. The study revealed that, although the global average temperature has been increasing, the warming has been primarily due to nighttime rather than daytime temperature increases, appearing as a decrease in the day-night temperature difference over land for the last 40 years.

Other conference findings include the following:

- The warming has not been truly global, nor has it been evenly distributed throughout the day and night. The warming that occurred over North America, most of Eurasia and portions of Africa and Australia during the last four decades has occurred mainly at night. In contrast to most climate model expectations, no significant nighttime warming has been observed in the polar regions. New Zealand and some Pacific islands have shown day and night temperatures increasing at similar rates.

- Increased cloud cover, which is associated with warmer nighttime temperatures, has been observed across North America, Australia, and Europe. Cloud cover at night acts as an insulator blanketing the Earth.

- Greenhouse gases, produced by industrial activity, affect the way in which the atmosphere releases heat to outer space. At the present rate of increase, concentrations of greenhouse gases will double in the twenty-first century. While climate models have shown that a decreased day-night temperature difference and nighttime warming may be expected to accompany increased atmospheric greenhouse gases, the magnitude of the modeled change is substantially smaller than that observed.

- Only part of the observed temperature change can be attributed to urban growth, a known factor in increased nighttime temperatures. Scientists believe that the cause of the decreasing day-night temperature difference may be related to the combined effects of an increase in greenhouse gases and cloud cover over continents with increased industrial sulfur emissions, also produced by the burning of fossil fuels. In fact, a climate model developed by James Hansen of the National Aeronautics and Space Administration that took these simultaneous increases into account came closer to simulating the observed temperature change than had previous models.

As human-produced greenhouse gases and industrial sulfur emissions continue, nighttime warming is also expected to continue. "The potential benefits of nighttime warming, such as a longer growing season and fewer killing frosts, may be offset by

the liabilities of increased pest infestations, reduced crop-growing area, and higher human heat-related mortality," said Larry Kalkstein, a conference panel leader and professor of climatology at the University of Delaware's Department of Geography.

Although the scientists admitted that their present knowledge of the impact of nighttime warming on climate is limited, they concluded that if future warming were to be confined to nighttime hours, adverse effects could still be expected.

Conference participants agreed that communication channels between countries should be kept open for easier access to regional data on nighttime warming. With improved observations, more attention to climate-environment interactions, and increased knowledge of cloud dynamics, scientists will have a better understanding of the impacts, causes, and future course of nighttime warming on climate.

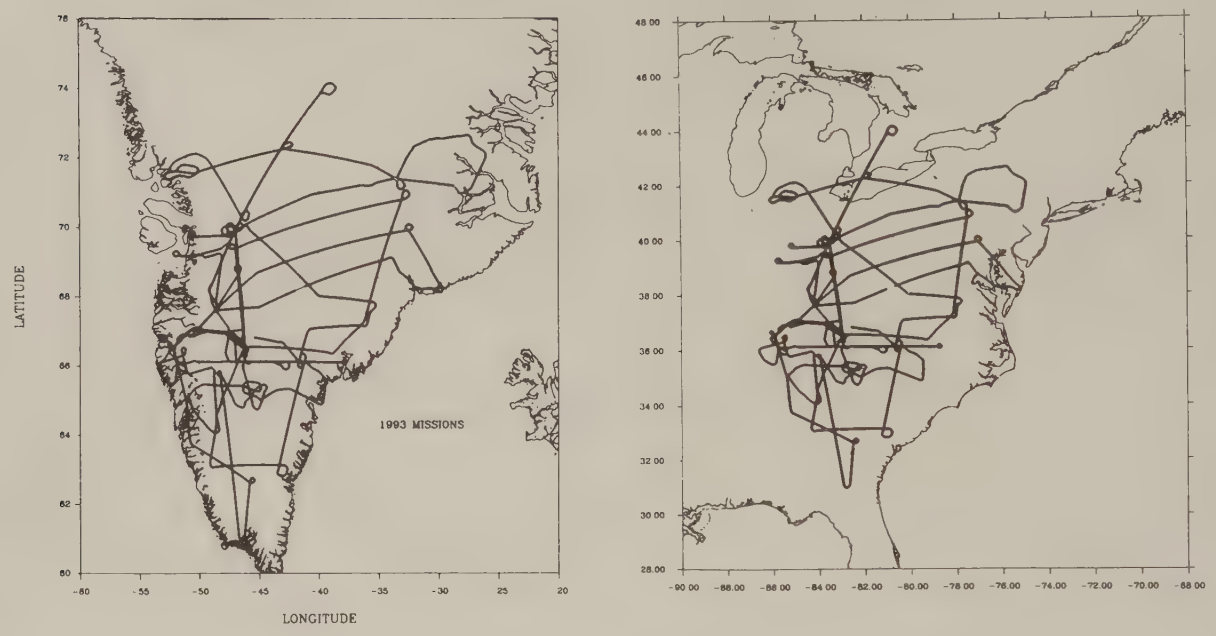
EOSDIS CORE SYSTEM

REQUIREMENTS REVIEW

The System Requirements Review (SRR) briefing for the EOS Data and Information System (EOSDIS) Core System (ECS) was presented by Hughes Applied Information Systems, Inc. (HAIS) to an audience of approximately 400 on September 14-15. Since the contract award on March 30, HAIS has supported reviews for project management and for prototyping, conducted technology evaluations, participated in meetings of EOSDIS Distributed Active Archive Center (DAAC) User Working Groups and ESDIS Focus Teams, interacted with EOS Instrument Teams to discuss toolkit specifications, established a Recommended Requirements Data Base to accept suggestions and requirements from users, provided a number of documents on ECS requirements specifications, operations concepts, and interface requirements, and hired and trained new personnel. Following the 2-day presentation of the SRR, 4 Focus Teams established by the ESDIS Project (Data Processing, Data Organization and Access, Science Operations, and Mission Operations) had concurrent 2-day meetings to discuss the SRR and to develop Review Item Discrepancies (RIDs). RIDs are one formal mechanism for documenting, evaluating, and responding to comments and/or critiques (but not the only mechanism for providing feedback). Discussions at the SRR and among the Focus Teams highlighted a number of actions that HAIS must take before proceeding with system design, including: provide a clear demonstration of the requirements for evolution/evolvability and of the ability to accommodate changes in user needs and technology; develop complete user/data models and scenarios validated through interactions with users; analyze and validate functional and performance requirements based on such models and scenarios; and develop a stronger link between user scenarios and operations concepts. These high-level issues and the more than 1000 detailed RIDs produced as a result of the SRR will be evaluated to determine further actions and development approaches.

Airborne Measurements of the Greenland Ice Cap

—**Doug Young**, Wallops Flight Facility, Aircraft Programs Branch, Wallops Island,Virginia. (804) 824-1443



During the recent Greenland glacier mapping campaign, the Wallops P-3B aircraft flew 60 hours of flight lines over the ice sheet. The map on the left shows the flight lines flown by the aircraft over the southern half of Greenland. The map on the right shows the Greenland flight lines superimposed on the eastern United States.

MISSION DESCRIPTION

The Goddard Space Flight Center's Wallops Flight Facility conducted an extremely successful and productive airborne deployment to the southern half of the Greenland ice cap during June and July of this year. The mission's ultimate purpose is to detect changes in the mass of the icecap caused by climatological changes. It is hoped that the northern end can be similarly mapped in 1994, and that the flightlines accumulated during these two deployments can be overflown repetitively in future years. The mission was sponsored by Robert Thomas, Code YS, NASA Headquarters. The Principal Investigator is William Krabill of Wallops, and a Co-investigator is Jack Bufton of Goddard.

The primary objective of the deployment was to sample the surface topography of the southern portion of the ice cap with absolute accuracies better than a decimeter. Major sources and sinks of the ice cap were overflown, as were several major glaciers. The deployment's flightlines have established an accurate baseline set of measurements to which future measurements can be compared.

The surface topography measurements are derived from merging GPS data (to give aircraft position) and laser-ranging data (to measure the distance between aircraft and ice surface). The primary laser carried by the P-3B aircraft was Krabill's Airborne Oceanographic Lidar (AOL). To enhance the probability of exactly overflying ground tracks in ensuing years, the AOL is scanned laterally about 110 meters to either side and makes 800 measurements every second. Bufton's Airborne Terrain Laser Altimetry System (ATLAS), the second major laser system aboard, provides a corroborative and independent range measurement, although only in a profiling mode, and making only 50 measurements every second.

There were also some secondary objectives. One was to evaluate the two laser systems aboard in a wide-beam-

divergence mode as a function of altitude. This test was dubbed "Bigfoot" and was sponsored by Miriam Baltuck of Code YS with Bufton serving as Principal Investigator.

Another objective was to evaluate the Coherent Antarctic Radar Depth Sounder (CARDS) operated by Prasad Guginini and graduate student Michael Stueart of the University of Kansas. CARDS measures the distance not only to the surface of the ice, but also to the bottom as well, thus yielding ice thickness with accuracies to within 5 meters.

Finally, the venerable AAFE (Airborne Altimetry Flight Experiment), the predecessor of the SEASAT radar, was flown. The AAFE first flew on Wallops aircraft 20 years ago. The purpose of the flight was to determine if this class of instruments is surveying *surface* topography as intended, or perhaps features somewhat below the surface.

AIRCRAFT AND CREW

The mission aircraft was the N426NA, the Wallops P3B four-engine turboprop, extensively modified to convert it into a remote-sensing aircraft. Contemporary digital avionics has been installed in its cockpit, and a data management system has been engineered to supply its digital data to any scientist onboard who desires it. A one-of-a-kind guidance system designed by Wallops' Wayne Wright uses an eight-channel GPS receiver and provides the cockpit with a steering signal which the flight crew can display and follow manually, or feed to the auto pilot. The steering signal permits a maximum of only ± 80 meters lateral deviation about the desired flightline.

Staffing of the mission was special to all aboard. There is a dichotomy in any flight crew deployed in a Wallops aircraft. Part of the crew consists of *service* personnel provided by Wallops to operate the aircraft—pilots, mechanics, and technicians. The remainder of the crew is the *science* personnel, or "range-users" in Wallops lingo, who contract the aircraft as an airborne platform for their research. For this deployment, the Wallops Mission Command Pilot was Virgil Rabine. Serving as an ATLAS electronics engineer with the science crew was a recent University of Maryland graduate named David Rabine—Virgil's son.

DEPLOYMENT RESULTS

The mission was very successful. Eleven flights totaling 60 hours of flight time were conducted in only 16 days, and over 100-million usable topographic observations were recorded.

Data reduction will continue for the next 6 - 8 months. The data accuracy is within the necessary decimeter standard, as shown by comparing aircraft data with independent ground survey data. There is even a flightline with several crossover points whose mutual measurements agree within 3 centimeters. To provide rigorous comparisons of topography from year to year, the pilots must be able to overfly the same flightlines with accuracies within the 100-meter footprint of the AOL. Analysis of pilot performance to date has shown that the N426 was flown within a wingspan (33 meters) of the desired flightline for about three-fourths of all flightline data points.

Data analysis for AAFE and CARDS is also ongoing. Preliminary results from examination of groundtrack crossover points reveals agreement for AAFE altimetry data within 15 centimeters. CARDS detected bedrock beneath the ice-cap summit and measured ice thicknesses there of about 3.2 kilometers. ▨

Father/son team, Virgil Rabine (left) and his son, David Rabine (right).

SPOT 3 Is Launched

—Clark Nelson, SPOT Image Corporation, Reston, Virginia. (703) 620-2200

The SPOT 3 Earth observation satellite was successfully launched into an 822 km high, sun-synchronous orbit on September 25, 1993 at 9:45 p.m. EDT. The "SPOT Constellation" now consists of three satellites, all of which continue to operate successfully, providing the highest resolution commercially available digital imagery to international clients.

The satellite is currently undergoing final orbital adjustments and technical tests, and has already transmitted image data to ground receiving stations. The in-flight commissioning phase is planned to last two months after which commercial operations will begin.

Future plans include the launch of a continuing series of satellites to provide image data well into the next century.

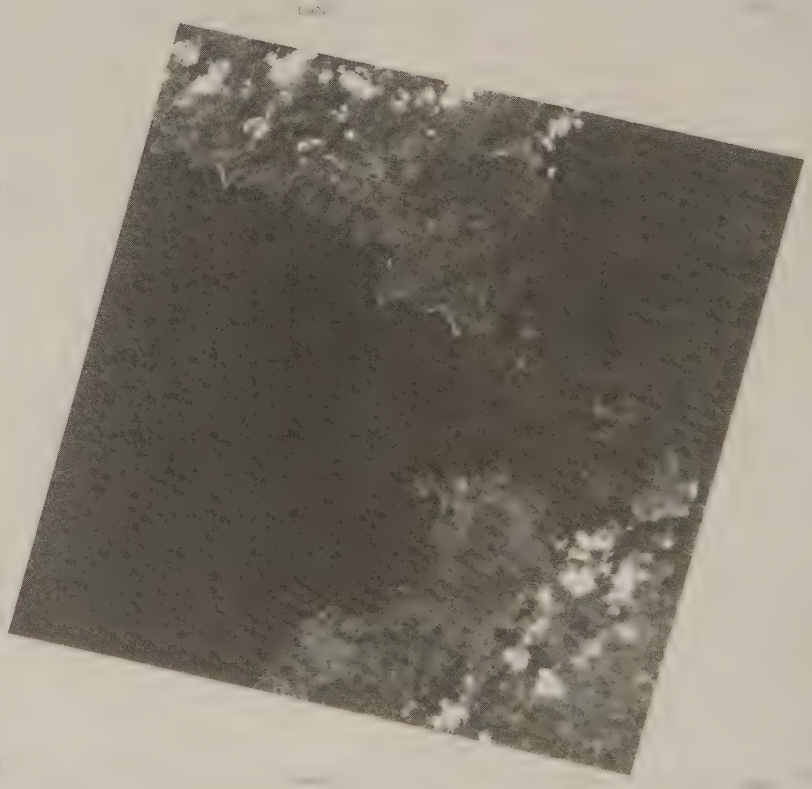
SPOT 3: The First View

The photograph shows the first image data transmitted by the SPOT 3 Earth observation satellite, 32 hours 45 minutes after launch. The scene, covering 60 km x 60 km, shows the Strait of Bonifacio separating Corsica (to the north) and Sardinia in the Mediterranean Sea.

The SPOT 3 First View images were acquired in both panchromatic (10 meter) and multispectral (20 meter) modes. The multispectral image shown here contains important radiometric and environmental information captured by the satellite's near-infrared sensors.

The image data were transmitted in real-time from the satellite to the Aussaguel receiving station outside of Toulouse, France. Preliminary processing was performed by CNES before the data were digitally transmitted over a dedicated 64 kb line to SPOT Image Corporation in Reston, Virginia.

At SPOT Image Corporation, the first image was processed as a geocorrected SPOTView®image map in universal transverse mercator (UTM) projection. Creation of a SPOTView image map typically involves applying ground control points (from existing maps or GPS) and elevation models of the local terrain relief to create a highly accurate representation of the Earth's surface. SPOTView horizontal accuracy is typically better than 15 meters.



This is the first image transmitted by the SPOT 3 Earth observation satellite launched on September 25, 1993 at 9:45 PM EDT. The scene is of the Strait of Bonifacio (separates Corsica from Sardinia in the Mediterranean) and was acquired 32 hours 45 minutes after launch. The image data have been processed as a SPOTView® image map.

Preparing for Climate Change – Report of the Office of Technology Assessment

(Remarks that follow are taken from a press release issued by the Office of Technology Assessment.)

Uncertainty about where, when, or how much climate change will occur makes preparing now for its impacts both "difficult and essential," according to the Congressional Office of Technology Assessment (OTA) in a report released October 25, 1993.

However, what the federal government decides *now* about the management of water supplies, forests, wetlands, fish, wildlife, and natural resources could limit or foreclose the ability of these resources and their managers to adapt to changing climate conditions, or could help us better prepare. Delay in taking action, may leave the Nation poorly prepared for the changes ahead, and may increase the possibility of irreversible impacts or costly surprises. Many of the options presented in the report could address problems already facing our natural resources and could be undertaken regardless of how the climate might change.

The ambitious $1.4 billion U.S. Global Change Research Program (USGCRP) is predominantly a physical science program aimed at observing, understanding, and predicting climate change. As currently structured, it will not provide decisionmakers and natural resource managers with the information they will need to respond to climate change.

The recent major drought in the western and southeastern United States, powerful hurricanes in Florida, and substantial flooding in the Midwest represent the types of extreme events that may occur with greater frequency if the climate warms.

Predicted climate changes include increased temperatures, rising sea levels, changing patterns of precipitation, and increased evaporation. Combined, these factors could significantly alter the Nation's natural resources. Resulting loss of soil moisture might present the greatest threat to natural systems.

Sea level rise could increase the erosion of shorelines and accelerate loss of coastal wetlands. Changes in precipitation could lead to more floods or droughts and disruption of water supplies. In regions that become drier, interior wetlands could be lost. The ideal ranges for plants and animals might shift hundreds of miles north as temperatures increase. Shifts in the range of agricultural crops and commercial tree species could lead to disruptions in rural communities. More frequent fire and die-back may occur in forests stranded outside their ideal climate range.

Since the 1992 United Nations Conference on Environment and Development (UNCED), more than 160 countries have signed the Climate Convention, seeking to freeze greenhouse gas emissions at 1990 levels in the near future. The United States has just announced its plan to return to 1990 levels by the year 2000. However, even under the most optimistic future emissions scenarios, average global temperatures are expected to increase several degrees over the next century as a result of past emissions.

OTA examined the ability of natural-resource-based systems to adapt to climate change and considered means to enhance adaptation by modifying management, advancing research and technology, disseminating information, and taking legislative actions. OTA focused on areas where: future costs may be very high; impacts may be irreversible; the validity of long-term decisions made today will be affected; preparing for catastrophic events is already warranted; and a significant federal role exists in research, planning, or management of these systems.

On the basis of this focus, OTA selected six systems for further analysis: coastal areas, water resources, agriculture, wetlands, preserves (federally protected natural areas), and forests. Each of these systems is stressed to some degree today, and that may influence how well it can respond to any future climate change. For example, because populations in coastal areas are growing, the exposure to costly natural disasters is increasing.

OTA grouped policy options under four themes shared by several or all systems: geographical and institutional fragmentation; inadequate communication of climate risk; the lack

of contingency planning to prepare for extreme events or weather surprises; and information gaps in various key scientific and policy areas. OTA considered more than 100 options in the full report.

Any policies that improve the chances of adapting to climate change more smoothly and painlessly provide buffers against its negative impacts. Of benefit are flexible policies that improve our ability to make quick self-adjustments or midcourse corrections as needed without major economic or social disruption. OTA also suggested actions necessary to ensure that the nation is prepared to cope with the potential for serious threats to its natural resources.

Copies of the 63-page Summary *Preparing for an Uncertain Climate* are now available without charge by calling (202) 224-8996. The full report will be published in late November.

(OTA is a nonpartisan agency that serves the U.S. Congress. Its purpose is to help legislators anticipate and plan for the positive and negative effects of technological change.)

EOS Science Calendar

• 1994 •

January 11-13	Investigators Working Group (IWG) Meeting, San Antonio, TX. Contact Ghassem Asrar at (202) 358-0259, or Michael King at (301) 286-8228.
February 1-3	LAWS Science Team Meeting, Clearwater, FL. Contact Wayman Baker at (301) 763-8019.
February 15	AIRS Science Team Meeting, University of California at Santa Barbara, Santa Barbara, CA. Contact Hartmut Aumann at (818) 397-9534.
February (TBD)	GLAS Science Team Meeting, NSIDC, Boulder, CO. Contact: Bob Schutz at (512) 471-4267. Email address: (schutz@utcsr.ae.utexas.edu).
April 13-15	MODIS Science Team Meeting, NASA/Goddard Space Flight Center, MD. Contact David Herring at (301) 286-9515.
May 25-26	TES Science Team Meeting, University of Denver, CO. Contact: Reinhard Beer at (818) 354-4748.

Correction to U.S. ASTER Science Team Report

(page 3 of *The Earth Observer*, July/August, 1993 edition)

In the last issue of *The Earth Observer*, Dr. Piers Sellers, EOS AM1 Project Scientist, was incorrectly quoted as saying that the National Meteorological Center's (NMC) 48-hour forecasts are extremely good as predictors of cloud cover, strongly suggesting that ASTER might obtain more cloud-free data if observation schedules could be up-linked to the spacecraft 24-48 hours before acquisition.

The statement should have read that the NMC 48-hour cloudiness forecasts are *indeed* better than estimates based on persistence, but their utility for ASTER scheduling is still being evaluated.

EOS IWG Meeting Information and Registration

GENERAL INFORMATION
The EOS IWG Meeting is scheduled for January 11-13, 1994 at the Sheraton Gunter Hotel, San Antonio, Texas. Registration and a continental breakfast will begin on Tuesday, January 11, 1994 at 7:30 a.m. on the Mezzanine level in front of the ballroom. A registration fee will be collected for those planning to attend the EOS Reception scheduled for Tuesday evening. All attendees are requested to preregister for this meeting. Presenters are requested to turn in a hard copy of their presentation materials at the registration desk.

AGENDA
A preliminary meeting agenda will be available in mid December.

PER DIEM
Government per diem in the San Antonio, TX area is $64/lodging, and $30/meals (total of $94.00).

HOTEL ACCOMMODATIONS
Jorge Scientific Corporation (JSC) has blocked 125 rooms at the Sheraton Gunter Hotel. Travel and lodging reservations and payments are each individual attendee's responsibility. To make a reservation at the hotel, call the Reservation Department at (800) 222-4276; fax (210) 227-3241 and identify yourself as part of the EOS IWG Meeting. The cut-off date for room reservations is December 20, 1993. After this date rooms and government rates are subject to availability. The rates for a single occupancy per night is $65.00 plus 15% tax ($74.75 per night), double occupancy per night is $85.00 plus 15% tax ($97.75 per night divided by 2 people is $48.88 each). All Government employees will be tax exempt upon submission of a tax exempt form to the hotel. Government employees will be required to present their Government ID upon check-in. Single occupancy rooms have the choice of three bed types, king, queen, or full. Be sure to specifiy bed type when making your reservation if this is a concern to you. Hotel check-in time is 3:00 p.m; check-out time is 12:00 noon. All reservations will need to be guaranteed for late arrival with either a major credit card or an advance deposit. If you need to cancel your reservation, please contact the Sheraton Gunter Hotel 48 hours in advance of the date of your scheduled arrival or you will be charged for one night's stay.

AIR TRAVEL
The San Antonio Airport is located approximately 8 miles or 15 minutes from the hotel, and is the only airport in the area.

GROUND TRANSPORTATION
The Star Shuttle is the exclusive shuttle for the San Antonio Airport, providing service to all the downtown hotels. The current cost is $7.00 per person and $4.00 for each additional person. The Star Shuttle is conveniently located at the airport baggage claim section. Taxicabs are also available; the current fare from the airport to the downtown area is $13.00-$15.00. Written directions and maps from the airport to the hotel are included in the logistics package.

COMPUTER SUPPORT
Jorge Scientific Corporation will provide on-site administrative/clerical assistance to generate viewgraphs, documentation, or access telemail accounts. The workroom will be equipped with a DOS computer, a Macintosh computer and modem, a laser printer, and a copier. Blank transparencies and other general office supplies will be available as well.

PHOTOCOPYING
To expedite photocopying, attendees are also strongly urged to send one copy of presentation material to be distributed to all participants during the meeting to Sarah Wager at Jorge Scientific Corporation, 7500 Greenway Center Drive, Suite 1130, Greenbelt, Maryland, 20770 by January 5, 1994. Photocopies will be made in advance and available at registration. Please mark materials that may be confidential or for restricted distribution. Presenters are requested to turn in a hard copy of their presentation materials at the registration desk

MESSAGES
Messages can be received during the meeting. Telephone numbers for the hotel telephone lines dedicated to this meeting will be provided in the logistics package.

PARKING
Parking at the Sheraton Gunter Hotel is $9.00 per day.

SOCIAL EVENTS
An EOS Reception will be held on Tuesday, January 11, 1994. The cost for the reception will be between $15-$20. The reception will include a barge ride on the famous San Antonio Riverwalk. Further details for the reception will be provided in the logistics package. Meeting attendees need to sign up for this reception in advance to ensure we reserve enough barges to accommodate everyone.

Please fill out the EOS IWG Registration Form provided below and return to Sarah Wager by December 27, 1993. A LOGISTICS PACKAGE WILL ONLY BE MAILED TO PEOPLE WHO RETURN THE FOLLOWING REGISTRATION FORM. If you have any further questions concerning logistics, please contact Sarah Wager at (301) 220-1701, by fax at (301) 220-1704, or on E-mail at swager@gsfcmail.nasa.gov.

NASA/EOS IWG Meeting
Registration From

January 11-13, 1994
San Antonio, Texas

Please print clearly

Attendee Name _____

Affiliation _____

Business Address _____

City_____ **State**_____ **Zip** _____ **Country**_____

E-Mail Address _____

Role in the EOS Project _____

Telephone _____ **Facsimile** _____

☐ Yes, I plan to attend the IWG Meeting.

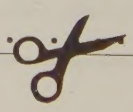
☐ No, I do not plan to attend the IWG Meeting.

☐ Yes, I plan to attend the reception and barge ride.

☐ No, I do not plan to attend the reception and barge ride.

Please return registration to:

NASA EOS IWG Meeting
Attn: Sarah Wager
Jorge Scientific Corporation
Conference/Document Support Office
7500 Greenway Center Drive
Suite 1130
Greenbelt, Maryland 20770



Global Change Calendar

• 1994 •

January 23-28	74th Annual Meeting of The American Meteorological Society, Nashville, Tennessee. Contact Yale Schiffman, 1701 K Street, N.W., Suite 300, Washington, D.C. 20006-1509, phone: (202) 466-6070; FAX: (202) 466-6073.
Jan. 31-Feb. 2	Second Thematic Conference on Remote Sensing for Marine and Coastal Environments: Needs, Solutions, and Applications, New Orleans, Louisiana. Contact Robert Rogers, ERIM, P.O. Box 134001, Ann Arbor, Michigan 48113-4001, phone: (313) 994-1200, ext. 3234, FAX: (313) 994-5123.
Feb. 18-23	American Association for the Advancement of Science, San Francisco, California. Contact Stephanie Brooks, phone: (202) 326-6711.
March 1-4	7th Australasian Remote Sensing Conference, Melbourne, Australia. The Conference will be held in conjunction with: 1) The Inter-Congress Symposium of Commission 5 of the International Society for Photogrammetry and Remote Sensing (ISPRS), 2) The second Australian Photogrammetric Conference, and 3) The Pacific Ocean Remote Sensing Conference (PORSEC 94). Contact: Michael McLean/Secretary to the Organizing Committee, 7th ARSC Conference Secretariat, P.O. Box 29, Parkville, Victoria 3052 Australia, phone: (03) 387 9955, FAX: (03) 387 3120.
March 8-11	Oceanology International 94, Brighton, UK. The theme of the conference is *The Global Ocean: from Ocean Understanding to Sustainable Development* and the program will emphasize the international dimension of the marine environment, the need to understand it, and the need for the protection and sustainable development of its resources. Also on this occasion the first conference of the International OTEC/DOWA Association will be held within OI94. Contact Lesley Ann Sandback, Spearhead Exhibitions Ltd, Rowe House, 55-59 Fife Road, Kingston upon Thames, Surrey KT1 1TA, UK, phone: 081 549 5831 (International: +44 81) FAX: 081 541 5016 or 081 541 5016 (International: +44 81).
March 29-April 2	Association of American Geographers 1994 Annual Meeting, San Francisco, California. Contact Ronald Abler, 1710 16th St. N.W., Washington, D.C. 20009-3198, phone: (202) 234-1450; FAX: (202) 234-2744, Internet: AAG@GWUVM.GWU.EDU; Bitnet: AAG@GWUVM.
March 30-April 2	Seventh Annual Geographic Information Systems Conference, sponsored by the Department of Geography and Environmental Planning at Towson State University. Contact John M. Morgan, III, Department of Geography and Environmental Planning, Towson State University, Baltimore, Maryland 21204-7097, phone: (410) 830-2964, FAX: (410) 830-3888, Internet: E7G4MOR@TOE.TOWSON.EDU.
April 26-28	1994 ASPRS/ACSM Annual Convention & Exposition, Reno, Nevada. Contact: Denise Cranwell, phone: (301) 493-0200
May 9-12	Tenth Thematic Conference on Geologic Remote Sensing: Exploration, Environment, and Engineering, San Antonio, Texas. Contact Robert Rogers, ERIM, P.O.Box 134001, Ann Arbor, Michigan 48113-4001, phone: (313) 994-1200, ext. 3382, FAX: (313) 994-5123.
May 23-27	1994 American Geophysical Union Spring Meeting, Baltimore Convention Center, Baltimore, Maryland. Contact Sherry Washington, 2000 Florida Avenue, N.W., Washington D.C. 20009, phone: (202) 462-6900, FAX: (202) 328-0566.
September 5-9	Call for Papers for ISPRS Commission III Symposium, "Spatial Information from Digital Photogrammetry and Computer Vision," Munich, Germany. Contact Christian Heipke, Secretary, ISPRS Commission III 1992-1996, Chair for Photogrammetry and Remote Sensing, Technical University Munich, Arcisstr. 21, D-80290 Munich, Germany. Phone: +49-89-21052671 (2677), FAX: +49-089-2809573, or Email: chris@photo.verm.tu-muenchen.de.
September 11-15	First International Airborne Remote Sensing Conference and Exhibition: Applications, Technnology, and Science, Strasbourg, France. Contact Robert Rogers, ERIM, Box 134001, Ann Arbor, Michigan 48113-4001, phone: (313) 994-1200, ext. 3234; FAX: (313) 994-5123.

Code 900
National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771

Official Business
Penalty For Private Use, $300.00

Postage and Fees Paid
National Aeronautics and
Space Administration
NASA-451

U.S.MAIL

JIMAR Motell
2570 Dole Street

Honolulu HI 96821
USA

The Earth Observer

The Earth Observer is published by the EOS Project Science Office, Code 900, NASA/Goddard Space Flight Center, Greenbelt, Maryland 20771, telephone (301) 286-3411, FAX (301) 286-1738. Correspondence may be directed to Charlotte Griner at the above address. Articles (limited to three pages), contributions to the meeting calendar, and suggestions are welcomed. Contributions to the meeting calendar should contain location, person to contact, and telephone number.

To subscribe to *The Earth Observer*, or to change your mailing address, please call Hannelore Parrish at (301) 441-4032, or send message to Internet address: hparrish@ltpsun.gsfc.nasa.gov, or write to the address above.

The Earth Observer Staff:
Executive Editor: Charlotte Griner
Technical Editor: Renny Greenstone
Associate Technical Editor: Bill Bandeen
Design and Production: Winnie Humberson
Distribution: Hannelore Parrish

GREENBELT MD 0002393

PENALTY FOR PRIVATE USE $300
METER 430184
0075
U.S. POSTAGE